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(54) Title: SINGLE DISPLAY FOR VEHICLE WITH MULTIPLE VIEWING DIRECTIONS (57) Abstract <p>An improved display system for a vehicle includes a single display panel associated with an optical system designed to direct an image from the display panel in the direction of two vehicle occupants. As an example, the optical system will direct the image to both the driver and the passenger. The system may include a simple lens splitter arrangement. In one embodiment, the system utilizes a mirror having a curved inner surface such that the image is properly aligned with sight lines of the two occupants.</p>		

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SINGLE DISPLAY FOR VEHICLE WITH MULTIPLE VIEWING DIRECTIONS

BACKGROUND OF THE INVENTION

This invention relates to the use of a single visual display for a vehicle, which
5 may be viewed by occupants sitting in two different directions from the display.

Reconfigurable displays are becoming widely utilized in vehicle applications.
Such displays are placed into the vehicle cab, and provide information to the driver
and passenger. As an example, vehicle displays which provide information with
regard to the speed, fuel level, etc. are known. Historically, these displays have
10 been fixed displays such as a speedometer dial. More recently, reconfigurable
graphical display panels have been used in vehicles.

For much of the information on the display, it would be desirable that it be
easily seen by not only the driver, but also the passenger. As an example, one type
of display is used with navigation systems which assist the operator in finding a
15 destination, and rely upon a global positioning system. Often the passenger acts as
a navigator to assist the driver in deciding when to turn. However, a single display
screen is not easily seen by two individuals within a vehicle cab. The most common
display technology, liquid crystal display (LCD) has a narrow viewing angle. The
display screen cannot be easily viewed by both the driver and the passenger. Since
20 the driver may sometimes drive alone, the display screens have typically been
positioned to be visible to the driver.

The provision of a second display screen directed to the passenger is not
always a practical solution as display screens are relatively expensive. These display
screens are typically liquid crystal display (LCD), light emitting diode (LED),

electro-luminescent display (ELD) plasma based displays or similar displays. All are relatively expensive as compared to other components on the dashboard.

It would be desirable to provide a system which may be viewed by both the driver and the passenger, but which only requires one display screen.

5

SUMMARY OF THE INVENTION

In a disclosed embodiment of this invention, a single display screen is provided with an optical system that make its image easily viewed by individuals sitting both in the driver's and passenger seat in a vehicle. In one embodiment, this is achieved by a lens system which receives the image, and then bends the image in
10 the direction of both the driver and the passenger. In one preferred embodiment, a Fresnel lens is utilized.

In another embodiment, the image is passed into a splitter which directs a portion of the light to one of the two occupants. The remainder of the light passes through the splitter and is directed either at the other occupant, or off a reflector to
15 be directed at the other occupant. The splitter can be curved, or straight. If straight, it may necessarily to include a reflector to result in the proper orientation of the images.

Finally, a display may be placed within a reflector having a forward opening. The reflector has a curved inside surface. The display is reflected onto various
20 curved surfaces of the reflector inner surface. By looking through the central opening, both the driver and the passenger will have a reflected image at a proper alignment for their positions. In this way, the image is easily visible to both the driver and the passenger.

Also, the displays can be arranged such that different portions of images are directed to the two locations.

In addition, the optical systems can perform amplification such that a smaller display can be used. The amplification also provides for further viewing distance.

5 These and other features of the present invention can be best understood from the following specification and drawings, the following of which is a brief description.

BRIEF DESCRIPTION OF THE DRAWINGS

10 Figure 1a shows a first embodiment system visible to one occupant of a vehicle.

Figure 1b shows the first embodiment visible to the driver.

Figure 1c shows the first embodiment visible to an occupant in the passenger seat.

Figure 2a shows a second embodiment system.

15 Figure 2b shows a third embodiment system.

Figure 3 shows a fourth embodiment system.

Figure 4 shows a fifth embodiment system.

Figure 5 shows a sixth embodiment system.

Figure 6 shows a seventh embodiment system.

20 Figure 7 shows an aspect of the Figure 6 system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A display system 20 is mounted on a vehicle 21, shown schematically, in Figure 1a. As shown, the display screen 22 may be a known display such as a reconfigurable LED or ELD display. A curved mirror 24 surrounds the display 22.

5 A forward opening 26 is positioned forwardly of the display 22, and provides an entrance into the curved mirror 24. The inner surface of curved mirror 24 is reflective.

As shown in Figure 1a, an occupant sitting directly in front of the display will have access to the image of the display. This occupant can be either the driver, the

10 passenger, or the display can be positioned along a lateral central axis of the vehicle such that the image shown in Figure 1a is actually directed at a passenger in the rear of the vehicle.

Figure 1b shows the sight line of an individual 30, along line 32. As shown, the image from display 22 will bounce off the area 34 of the mirror 24, and then

15 onto an area 36. Area 36 is aligned with line 32 such that occupant 30 can see the image along this line. The occupant 30 may be the driver of the vehicle if the display 22 is mounted adjacent the lateral center of the vehicle.

Figure 1c shows the same system being visible to the passenger 38. Sight line 40 is positioned through opening 26. The image from display 22 bounces off

20 area 42, onto area 44, and is aligned with line 40. Note that amplification occurs with this embodiment such that all three views appear to be of the same size screen.

Figure 2a shows a lens system 46 positioned forwardly of a display 48. Lens 49 consists of two side portions 50 having curved rear surfaces 51. The curved rear surfaces amplify the image from the display 48 as desired. The same amplification

can occur with a curve on the front surface. The occupants 52 and 54 are positioned such that the lens portion 50 direct the image along the proper sight lines.

Figure 2b shows another embodiment 58, wherein the lens is a Fresnel lens having two halves 60 with louvers 61. Again, the images are directed as appropriate for occupants 52 and 54. The shape of the Fresnel lens is simplified. Actual Fresnel lens have on the order of 50 steps per inch.

Figure 3 shows another embodiment 62 wherein a display 64 directs its image generally parallel to the instrument panel 66 of the vehicle. A splitter 68 directs a portion of the image to a first occupant 70. The remainder of the image passes through the splitter to a reflector 72 which passes the image to a second occupant 74. Splitters are known which are operable to reflect a portion of an image in one direction while passing the remainder.

Figure 4 shows yet another embodiment 79. In embodiment 79 a display 80 directs an image off of a curved splitter surface 82. A portion of the image passes directly to the first occupant 84, and the remainder of the image is reflected to a second occupant 86. In this embodiment, second occupant 86 is beyond the focal length of the reflector, thus correcting for inversion of the reflection. Also since this embodiment uses a cylindrical arc it does not invert the image top to bottom.

Figure 5 shows yet another embodiment 88, which is similar to the Figure 4 embodiment. However, the splitter 90 is planar, not curved. Thus, the image is directed off of a reflector 92 before passing to the second occupant 86 such that it is in the proper orientation.

Several embodiments are shown wherein an optical system is provided for directing a single image to two occupants. The several embodiments eliminate the expense of providing two optical displays to the two occupants.

In addition, the image could be projected onto a screen, similar to a movie projector effect. The movie projector effect would replace the display screens described above. All of the various optical systems could be utilized with this type arrangement. The previously described lenses can now be surface-frosted lenses, or translucent plastic. This provides additional flexibility because the light need not be reflected directly to the person viewing the light.

Figure 6 shows another embodiment wherein the display 100 is shown to consist of three sections 102, 104 and 106. As can be seen, section 102 includes information such as speed and fuel information primarily of interest to the driver. Section 104 can display navigation information. Section 106 displays entertainment information such as a movie.

As shown in Figure 7, by properly designing and arranging lenses 108 and 110, the driver 112 will see the sections 102 and 104 while the passenger will see the sections 104 and 106. Other arrangements can be easily reached of this basic concept. As an example, perhaps the entire information would be provided to the driver or the passenger, with the other receiving less than the entire information. Further, the type of information being provided and shown in these figures is exemplary. Obviously, many types of information can be displayed, and can be transmitted to the driver or passenger as appropriate.

Another arrangement can utilize a fiber optic system to pipe the image to a location adjacent to another occupant, such as in the back seat.

The lenses and reflector set forth in this application can be made of materials known to workers in the art. They could be made out of glass, plastics, acrylics, or liquid-filled materials.

Although several embodiments are shown, a worker of ordinary skill in the art would recognize that other modifications would come within the scope of this invention. Thus, the following claims should be studied to determine the true scope and content of this invention.

WHAT IS CLAIMED IS:

1. Vehicle display system comprising:
a display panel mounted within a vehicle; and
an optical system for receiving an image from said display panel, and
5 directing said image in two directions associated with two occupants of said vehicle.
2. A system as recited in Claim 1, wherein a lens is positioned adjacent
said display panel, said lens resulting in said image being directed into said two
directions.
3. A system as recited in Claim 2, wherein said lens consists of two
10 distinct lens portions each directed at one of two occupants.
4. A system as recited in Claim 3, wherein a Fresnel lens is utilized.
5. A system as recited in Claim 3, wherein a surface of said lens portions
is curved to result in amplification of said image.
6. A system as recited in Claim 1, wherein said image is directed through
15 a splitter, said splitter directing the image in one of said two directions at one
occupant.

7. A system as recited in Claim 6, wherein said display panel directs said image generally parallel to an instrument panel of said vehicle, said splitter directing said image to an occupant facing said instrument panel.

8. A system as recited in Claim 7, wherein a reflector is positioned downstream of said splitter, said reflector positioned to direct said image to a second occupant.

9. A system as recited in Claim 6, wherein said display panel is positioned to direct said image at one occupant, and said splitter is positioned to be directed at a second occupant.

10. A system as recited in Claim 9, wherein said splitter is curved.

11. A system as recited in Claim 9, wherein said splitter is generally planar, and said image from said splitter passing to a reflector before being directed to the second occupant.

12. A system as recited in Claim 1, wherein said system includes a reflector having a curved inner surface, said display being positioned within said reflector, and said reflector having an opening, such that said image from said display panel is reflected onto said reflector at locations associated with sight lines through said opening to the two occupants.

13. A system as recited in Claim 12, wherein said reflector is generally curved and oval, and said opening is positioned forwardly of said display panel.

14. A system as recited in Claim 1, wherein said display panel includes different information and a plurality of different sections, and an optical system
5 being positioned adjacent said display panel such that a driver of the vehicle is provided with one set of said sections and a passenger in the vehicle is provided with a second set of the sections, with said first and second sets being non-equivalent.

15. A method of providing a display image in a vehicle comprising the steps of:

10 (1) providing a display panel, and an optical system associated with said display panel;

(2) providing an image on said display panel, and directing said image to said optical system, said optical system modifying said image such that said image is directed in two directions and towards two occupants of a vehicle.

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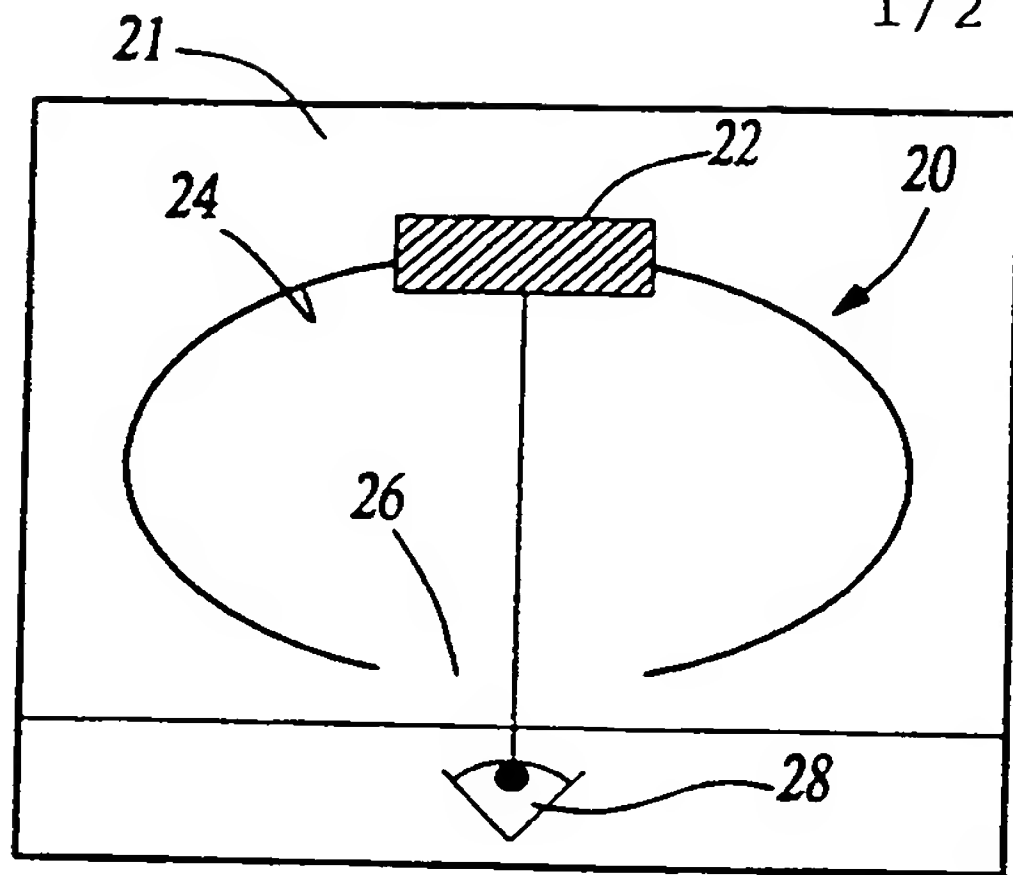


Fig-1A

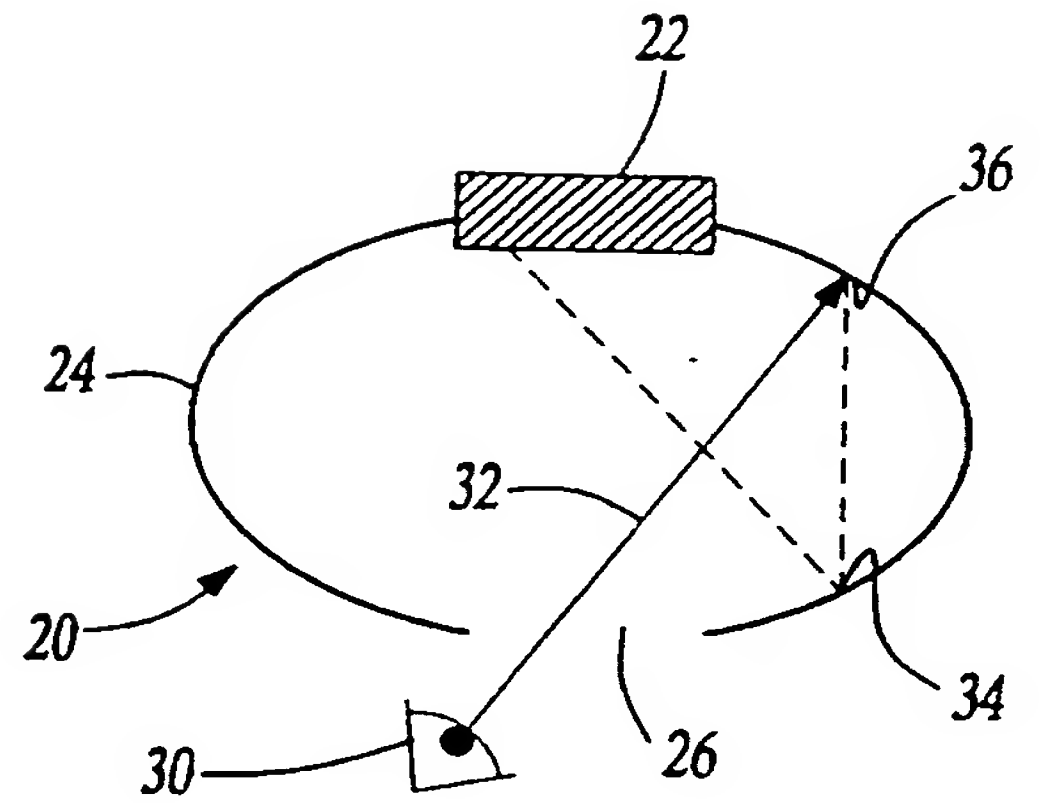


Fig-1B

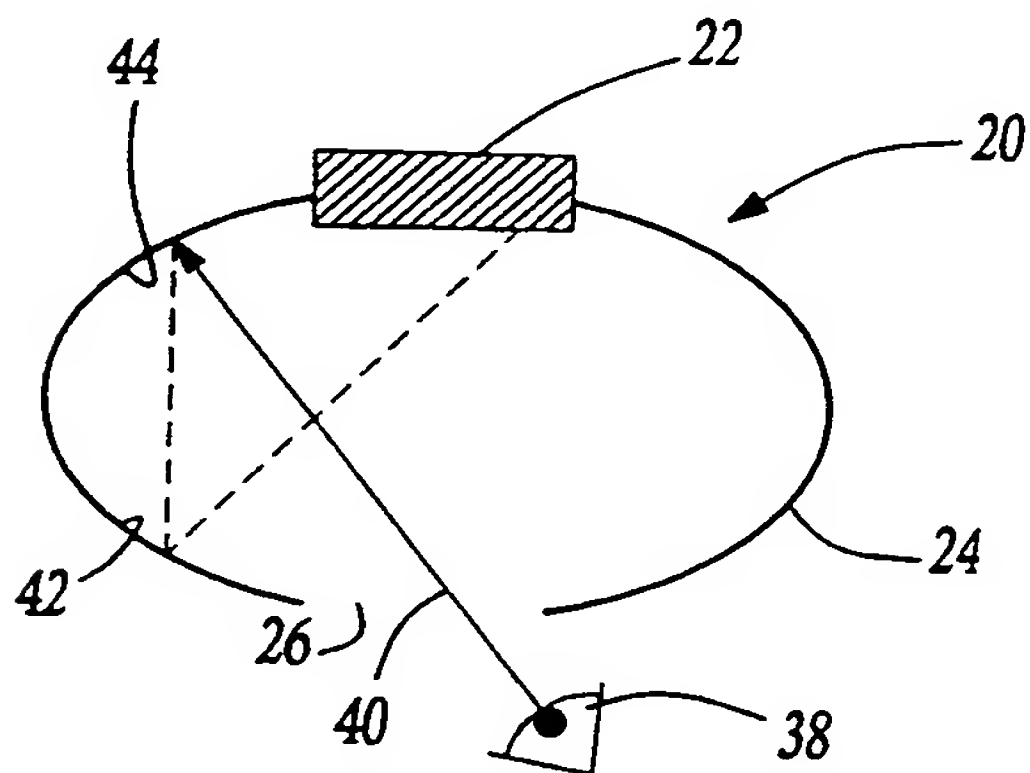


Fig-1C

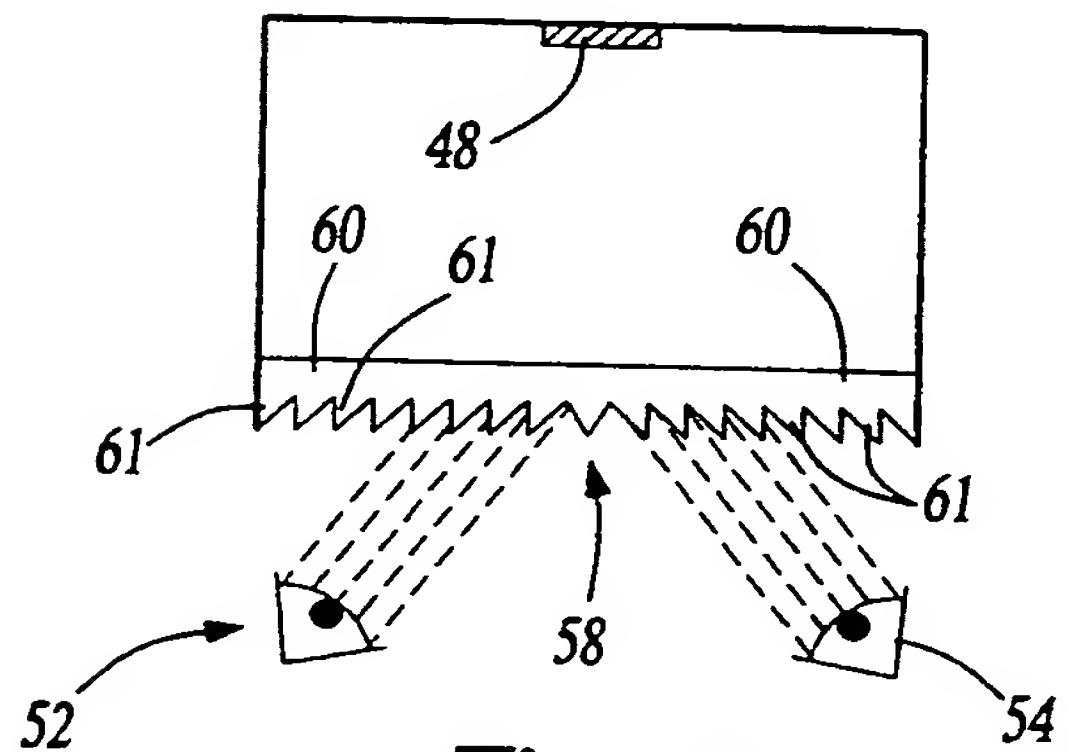


Fig-2B

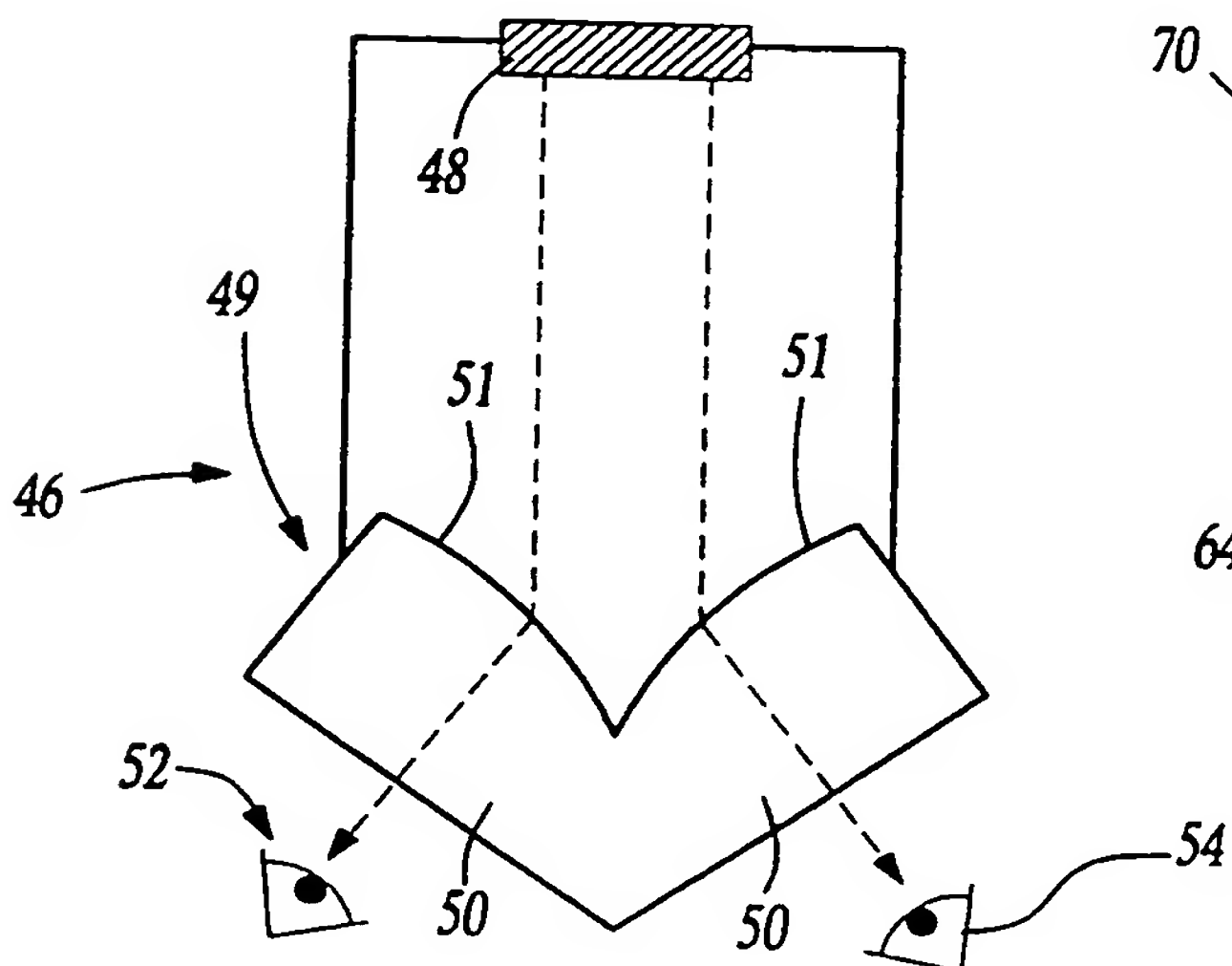


Fig-2A

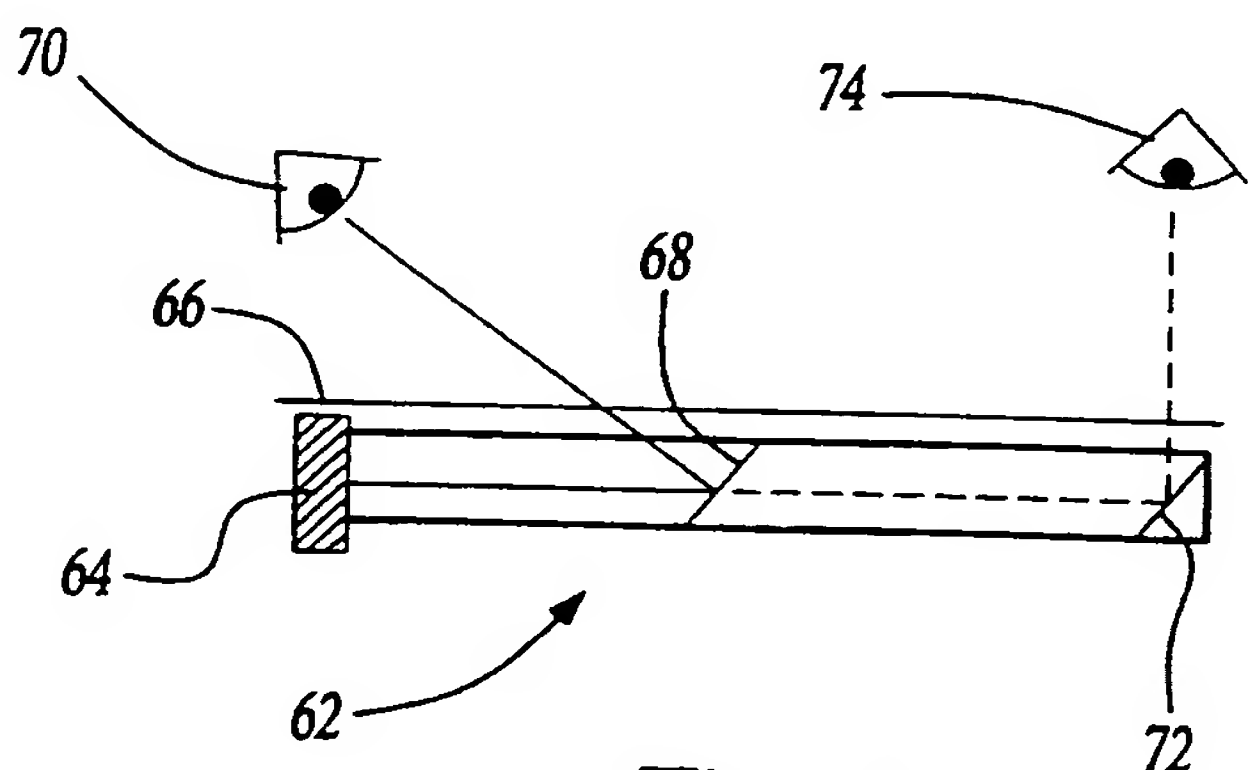


Fig-3

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Fig-4

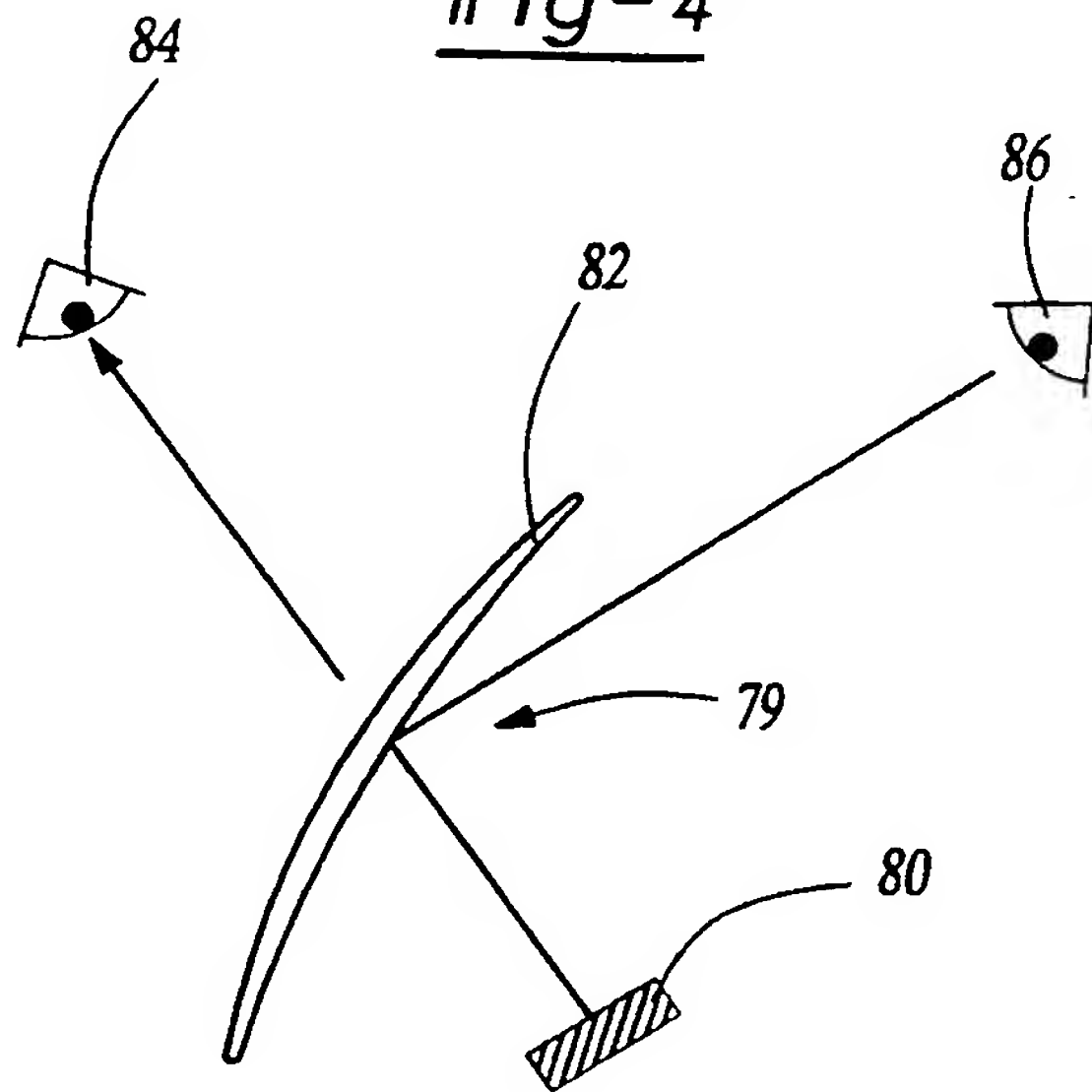


Fig-5

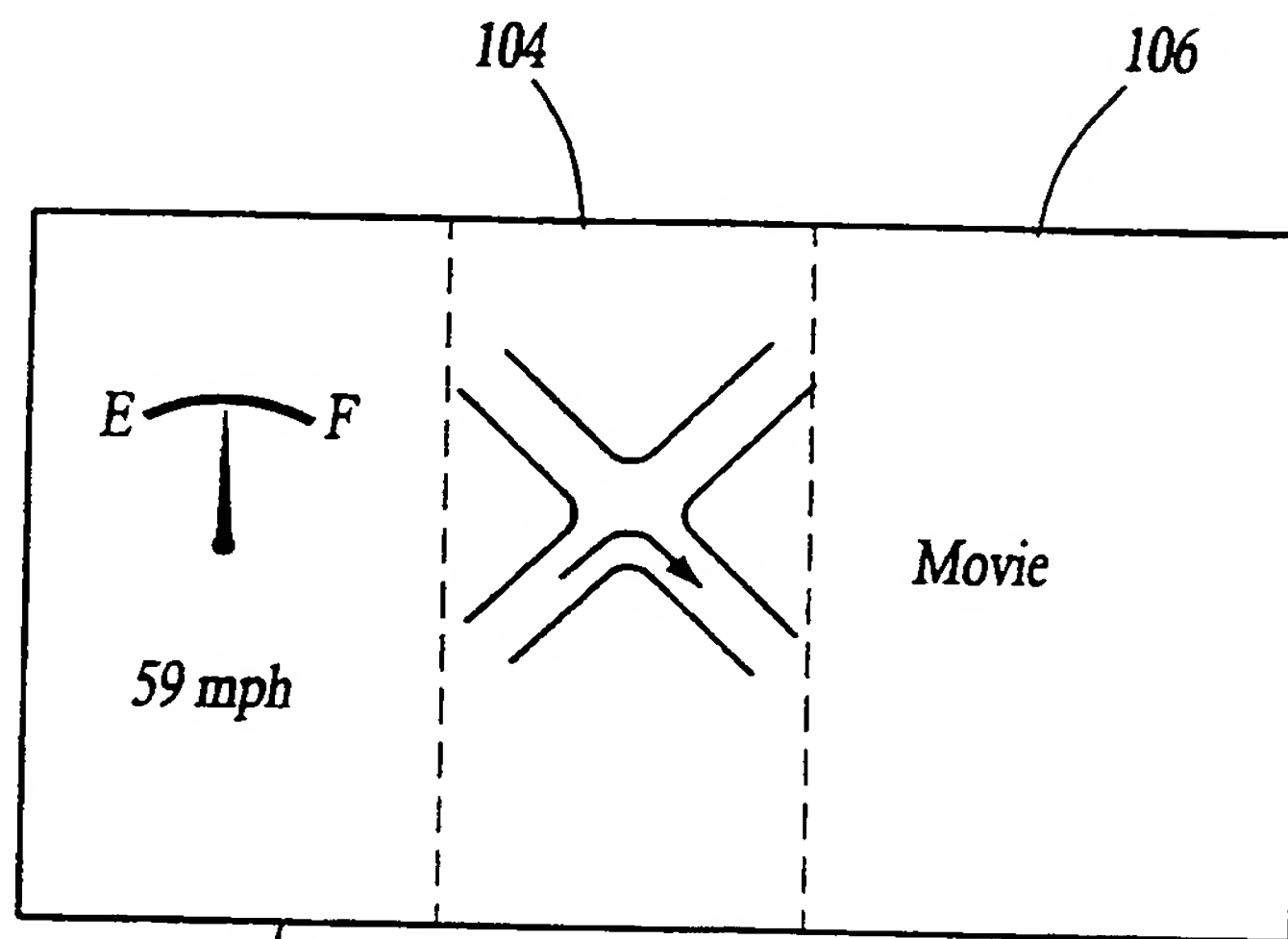
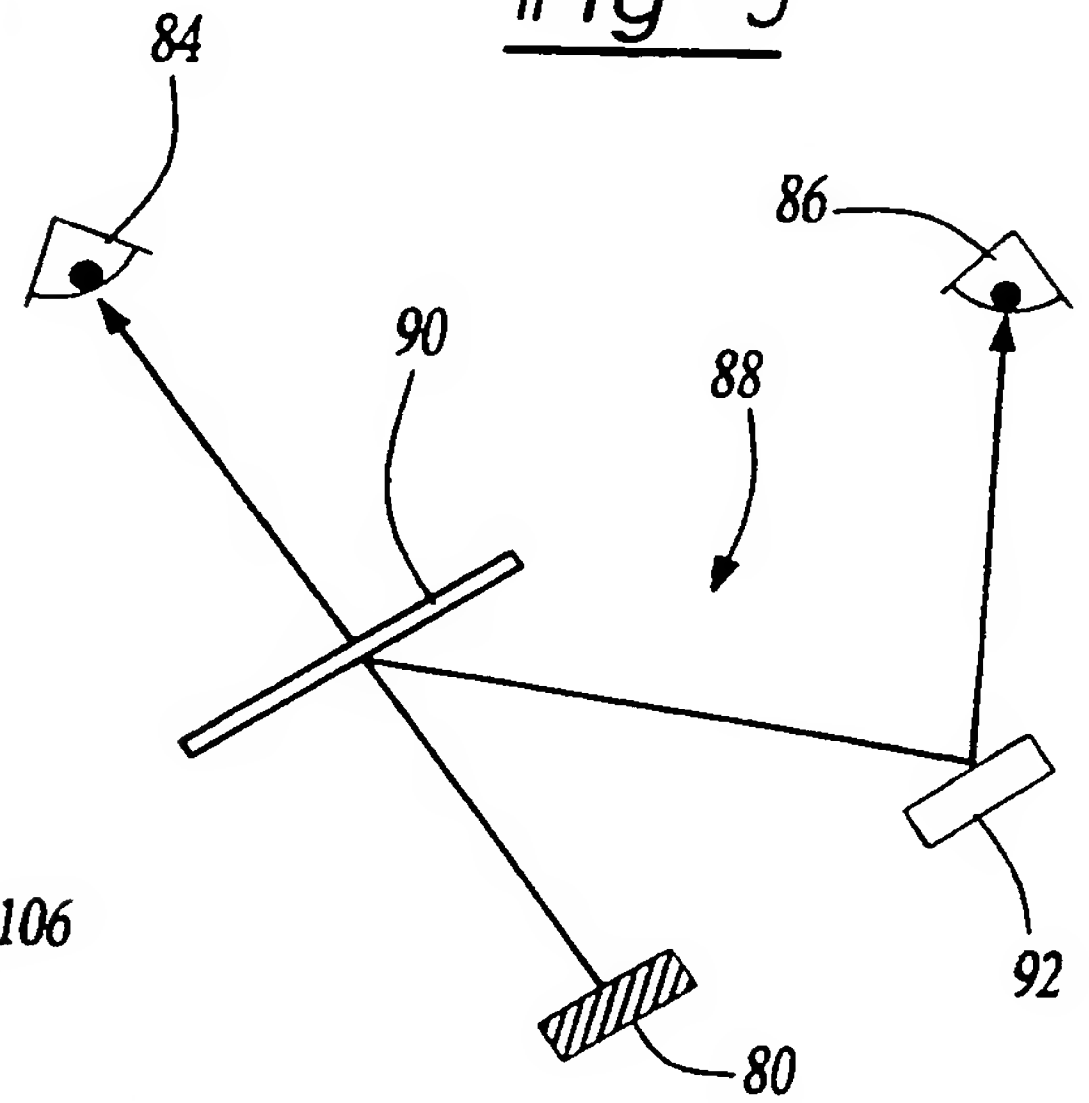
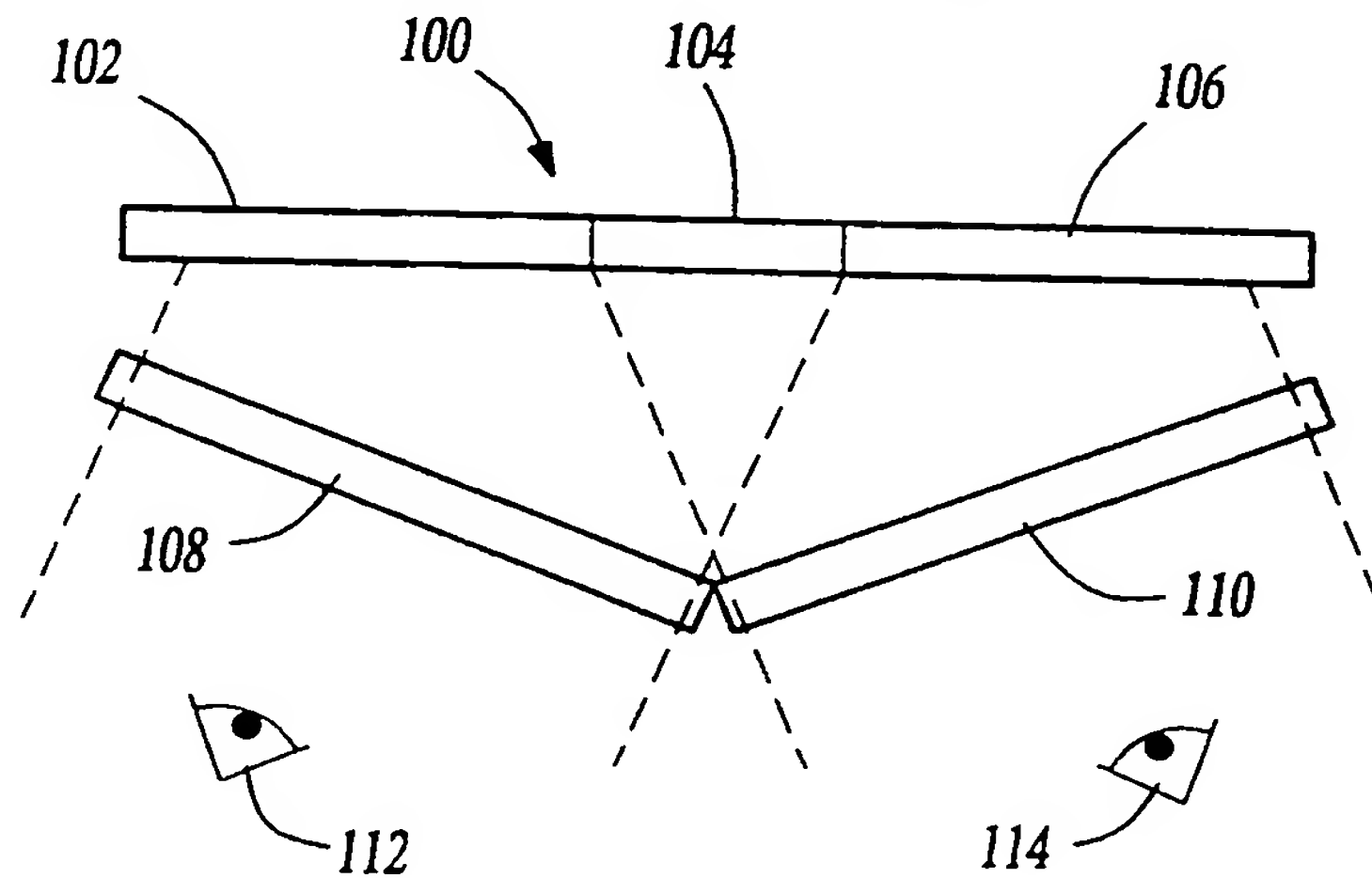


Fig-6

Fig-7



INTERNATIONAL SEARCH REPORT

Int'l Application No
PCT/US 99/12098

A. CLASSIFICATION OF SUBJECT MATTER

B 60 K 35/00

According to International Patent Classification (IPC) or to both national classification and IPC: 6

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B 60 K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5734358 A (SUMIYOSHI, K.) 31 March 1998, the whole document. --	1, 15
A	US 5032828 A (HIROSE et al.) 16 July 1991, abstract, fig. 1. --	1
A	GB 2270587 A (WILLIAM ALEXANDER COURTNEY) 16 March 1994, fig. 7. ----	4

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Date of the actual completion of the international search
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ANNEX

to the International Search
Report to the International Patent
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ANNEXE

au rapport de recherche inter-
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PCT/US 99/12098 SAE 237293

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This Annex lists the patent family
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